

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. 016907/0935

In re reissue patent application of

Susumu Hashimoto et al.

Serial No: Not yet assigned

Application for reissue of U.S. Patent No.
5,552,949, granted September 3, 1996

Filed: Herewith

For: MAGNETORESISTANCE EFFECT ELEMENT WITH IMPROVED
ANTIFERROMAGNETIC LAYER

REISSUE DECLARATION
UNDER 37 C.F.R. §1.175

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

We, Susumu HASHIMOTO, Yuzo KAMIGUCHI, Hitoshi IWASAKI, Atsuhito SAWABE, and Masashi SAHASHI, all citizens of Japan, declare that:

1. We believe we are the original, first and joint inventors of the subject matter described and claimed in our U.S. Patent 5,552,949 and in the foregoing specification for which a reissue patent is sought on the invention entitled: MAGNETORESISTANCE EFFECT ELEMENT WITH IMPROVED ANTIFERROMAGNETIC LAYER.

2. We have reviewed and understand the contents of the above-identified specification, including the claims.

3. We acknowledge the duty to disclose information which is material to examination of the application in accordance with 37 C.F.R. §1.56(a).

4. We claim benefit under 35 U.S.C. §119 for Japanese Application No. 5-043025 filed March 3, 1993, a certified copy of which is of record in the file of our original

Letters Patent 5,552,949.

5. There are no foreign applications or inventors certificates having a filing date before that of the application on which priority is claimed.

6. We believe U.S. Patent No. 5,552,949 ("the '949 patent") is wholly or partly inoperative or invalid by reason of our claiming less than we had the right to claim in the patent.

7. One specific error is the absence of claims of a breadth and scope covering a spin valve film.

8. More specifically, we now appreciate that we made errors by not claiming:

(reissue independent claim 11) A magnetoresistance effect element comprising a spin valve film having a first ferromagnetic layer and an antiferromagnetic layer, the antiferromagnetic layer comprising an alloy of PtMn.

(reissue dependent claim 12) A magnetoresistance effect element as set forth in claim 11, wherein said alloy is represented by $\text{Pt}_{100-x}\text{Mn}_x$, where x is an atomic % number in the range of $24 \leq x \leq 75$.

(reissue dependent claim 13) A magnetoresistance effect element as set forth in claim 11, wherein said alloy is represented by $\text{Pt}_{100-x}\text{Mn}_x$, where x is an atomic % number in the range of $40 < x \leq 70$.

(reissue dependent claim 14) A magnetoresistance effect element as set forth in claim 11, wherein said alloy is represented by $\text{Pt}_{100-x}\text{Mn}_x$, where x is an atomic % number in the range of $24 \leq x \leq 35$.

(reissue dependent claim 15) A magnetoresistance effect element as set forth in claim 12, wherein said alloy further comprises at least one element N' selected from the group consisting of Fe, Co, Pd, and Ni.

(reissue dependent claim 16) A magnetoresistance effect element as set forth in

claim 15, wherein said alloy has a ratio between Pt and N' represented by $Pt_{100-y}N'_y$, where y is an atomic % number in the range of $0 < y < 30$.

(reissue dependent claim 17) A magnetoresistance effect element as set forth in claim 11, wherein said alloy has a tetragonal crystalline structure.

(reissue dependent claim 18) A magnetoresistance effect element as set forth in claim 11, wherein the first ferromagnetic layer comprises a metal selected from the group consisting of Fe, Ni, Co, FeNi, FeCo, FeCoNi, and an alloy thereof.

(reissue dependent claim 19) A magnetoresistance effect element as set forth in claim 11, wherein the antiferromagnetic layer has a film thickness larger than that of the first ferromagnetic layer.

(reissue dependent claim 20) A magnetoresistance effect element as set forth in claim 11, wherein said alloy further comprises at least one element M' selected from the group consisting of transition metals, rare earth metals, and half metals.

(reissue dependent claim 21) A magnetoresistance effect element as set forth in claim 11, further comprising a nonmagnetic layer on the first ferromagnetic layer, and a second ferromagnetic layer on the non-magnetic layer, wherein the non-magnetic layer is provided between the first and second ferromagnetic layers.

(reissue dependent claim 22) A magnetoresistance effect element as set forth in claim 11, wherein PtMn is represented by $Pt_{100-x}Mn_x$, where x is an atomic % number in the range of $40 < x \leq 75$.

(reissue dependent claim 23) A magnetoresistance effect element as set forth in claim 16, wherein y is an atomic % number in the range of $1 \leq y \leq 10$.

(reissue dependent claim 24) A magnetoresistance effect element as set forth in

claim 16 further comprising a nonmagnetic layer on the first ferromagnetic layer, and a second ferromagnetic layer on the non-magnetic layer, wherein the non-magnetic layer is provided between the first and second ferromagnetic layers.

(reissue dependent claim 25) A magnetoresistance effect element as set forth in claim 20, further comprising a nonmagnetic layer on the first ferromagnetic layer, and a second ferromagnetic layer on the non-magnetic layer, wherein the non-magnetic layer is provided between the first and second ferromagnetic layers.

(reissue independent claim 26) A magnetoresistance effect element, comprising an exchange coupled film having a first ferromagnetic layer and an antiferromagnetic layer, the antiferromagnetic layer being on the first ferromagnetic layer, and the exchange coupled film being substantially free of corrosive pits, when the exchange film is exposed to an atmosphere having a relative humidity of 90%, at a temperature of 90 degrees centigrade for a time duration of 48 hours.

(reissue dependent claim 27) A magnetoresistance effect element as set forth in claim 26, wherein the exchange coupled film has less than a 10% probability for occurrence of corrosive pits.

(reissue dependent claim 28) A magnetoresistance effect element as set forth in claim 26 wherein the antiferromagnetic layer comprises an alloy of NMn, where N is at least one element selected from the group consisting of Cu, Ru, Rh, Re, Pd, Pt, Ag, Au, Os, and Ir.

(reissue dependent claim 29) A magnetoresistance effect element as set forth in claim 26 wherein the antiferromagnetic layer comprises an alloy of CrM, where M is at least one element selected from the group consisting of Ga, In, Cu, Rh, Pt, Pd, Ag, Os, Ir, and Co.

(reissue independent claim 30) A magnetoresistance effect element, comprising

a spin valve film having a first ferromagnetic layer, an antiferromagnetic layer, and an interlayer,

the interlayer being between the antiferromagnetic layer and the first ferromagnetic layer.

(reissue dependent claim 31) A magnetoresistance effect element, as set forth in claim 30, wherein the interlayer is made of a material selected from a γ ~ Mn alloy, a Co-Cr alloy, Cu, Ru, Rh, Re, Pt, Pd, Ag, Au, Os and Ir.

(reissue dependent claim 32) A magnetoresistance effect element as set forth in claim 31, wherein the interlayer has a thickness of 5nm or less.

(reissue dependent claim 33) A magnetoresistance effect element as set forth in claim 30, wherein the antiferromagnetic layer comprises an alloy of NMn, where N is at least one element selected from the group consisting of Cu, Ru, Rh, Re, Pd, Pt, Ag, Au, Os, and Ir.

(reissue dependent claim 34) A magnetoresistance effect element as set forth in claim 30, wherein the antiferromagnetic layer comprises an alloy of CrM, where M is at least one element selected from the group consisting of Ga, In, Cu, Rh, Pt, Pd, Ag, Os, Ir, and Co.

(reissue independent claim 35) A magnetoresistance effect element, comprising
a spin valve film having a first ferromagnetic layer and an antiferromagnetic layer, the antiferromagnetic layer being on the first ferromagnetic layer, the antiferromagnetic layer comprising an alloy of PtMn, wherein the antiferromagnetic layer is formed by heating in a magnetic field to provide unidirectional anisotropy.

(reissue independent claim 36) A magnetoresistance effect element, comprising
an exchanged coupled film having a first ferromagnetic layer and an antiferromagnetic layer, the antiferromagnetic layer being on the first ferromagnetic layer,

wherein the antiferromagnetic layer has an orientation of (101).

(reissue independent claim 37) A magnetoresistance effect element, comprising
a spin valve film having a first ferromagnetic layer and an
antiferromagnetic layer, the antiferromagnetic layer comprising an alloy of PdMn.

(reissue independent claim 38) A magnetic head comprising a
magnetoresistance effect element as set forth in claim 11.

9. We believe that the errors recited above and being presented for
correction in this reissue application arose without any deceptive intention on our part.

10. By this reissue declaration, we desire to seek broadened claims, and,
specifically, submit new claims for broadening reissue as submitted in the reissue
application herewith.

WHEREFORE, we pray that we may be allowed to surrender the original
Letters Patent 5,552,949 and do hereby offer same.

We hereby appoint Stephen A. Bent, Reg. No. 29,768; David A. Blumenthal,
Reg. No. 26,257; William T. Ellis, Reg. No. 26,874; John J. Feldhaus, Reg. No. 28,822;
Patricia D. Granados, Reg. No. 33,683; John P. Isacson, Reg. No. 33,715; Eugene M. Lee,
Reg. No. 32,039; Richard Linn, Reg. No. 25,144; Peter G. Mack, Reg. No. 26,001; Brian J.
McNamara, Reg. No. 32,789; Sybil Meloy, Reg. No. 22,749; George E. Quillin, Reg. No.
32,792; Colin G. Sandercock, Reg. No. 31,298; Bernhard D. Saxe, Reg. No. 28,665; Charles
F. Schill, Reg. No. 27,590; Richard L. Schwaab, Reg. No. 25,479; Arthur Schwartz, Reg.
No. 22,115; Harold C. Wegner, Reg. No. 25,258, Richard Linn, Reg. No. 25,144 and
Johnny A. Kumar, Reg. No. 34,649 as our attorneys with full power of substitution and
revocation to prosecute this application and to transact all business in the U.S. Patent and
Trademark Office connected herewith, and request that all correspondence be sent to
FOLEY & LARDNER, 3000 K Street, N.W., Suite 500, Washington, DC 20007-5109 at
(202) 672-5300.

The undersigned petitioners declare further that all statements made herein of their own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Susumu HASHIMOTO	
Signature: <u>Susumu Hashimoto</u>	Date: <u>Oct. 20, 1999</u>
Residence: <u>Ebina-shi, Japan</u>	
Post Office Address: <u>c/o Intellectual Property Division, KABUSHIKI KAISHA TOSHIBA,</u> <u>1-1 Shibaura 1-chome, Minato-ku,</u>	Citizenship: <u>Japanese</u> <u>Tokyo 105-8001, Japan</u>
Yuzo KAMIGUCHI	
Signature: <u>Yuzo Kamiguchi</u>	Date: <u>Oct. 20, 1999</u>
Residence: <u>Yokohama-shi, Japan</u>	
Post Office Address: <u>c/o Intellectual Property Division, KABUSHIKI KAISHA TOSHIBA,</u> <u>1-1 Shibaura 1-chome, Minato-ku,</u>	Citizenship: <u>Japanese</u> <u>Tokyo 105-8001, Japan</u>
Hitoshi IWASAKI	
Signature: <u>Hitoshi Iwasaki</u>	Date: <u>Oct. 20, 1999</u>
Residence: <u>Yokosuka-shi, Japan</u>	
Post Office Address: <u>c/o Intellectual Property Division, KABUSHIKI KAISHA TOSHIBA,</u> <u>1-1 Shibaura 1-chome, Minato-ku,</u>	Citizenship: <u>Japanese</u> <u>Tokyo 105-8001, Japan</u>
Atsuhito SAWABE	
Signature: <u>Atsuhito Sawabe</u>	Date: <u>Oct. 20, 1999</u>
Residence: <u>Yokosuka-shi, Japan</u>	
Post Office Address: <u>c/o Intellectual Property Division, KABUSHIKI KAISHA TOSHIBA,</u> <u>1-1 Shibaura 1-chome, Minato-ku,</u>	Citizenship: <u>Japanese</u> <u>Tokyo 105-8001, Japan</u>
Masashi SAHASHI	
Signature: <u>Masashi Sahashi</u>	Date: <u>Oct. 20, 1999</u>
Residence: <u>Yokohama-shi, Japan</u>	
Post Office Address: <u>c/o Intellectual Property Division, KABUSHIKI KAISHA TOSHIBA,</u> <u>1-1 Shibaura 1-chome, Minato-ku,</u>	Citizenship: <u>Japanese</u> <u>Tokyo 105-8001, Japan</u>